REMARKS

Claims 18 - 22 have been finally rejected. By this amendment, Claims 18, 19, 20 and 22 have been canceled. Minor amendments have been made to Claim 21 and Claim 25 has been added. Claim 25 is Claim 22 rewritten in independent form.

The Examiner has rejected Claims 18 - 22 under 35 USC 103(a) as being unpatentable over U.S. Patent No. 6,238,223 to Cobbley, et al. in view of U.S. Patent No. 5,128,746 to Pennisi, et al.

In this rejection, the Examiner reads the claims on Cobbley, et al. asserting the claims read on Cobbley, et al. except for the fact that Cobbley, et al. fail to disclose that the resin fills the spaces between SMD and the substrate, such that the resin forms fillets around the SMD solder connection. The Examiner further states that Cobbley, et al. further fails to disclose that the resin is formed from an epoxy-based flux encapsulant.

In an effort to correct for these deficiencies in Cobbley, et al., the Examiner relies upon Pennisi, et al. In this regard, the Examiner states that "Pennisi teaches that an underfill resin should be applied in such a manner that the resin completely fills the area between the SMD and substrate (column 2, lines 30 - 50, and further forms fillets (260) around the SMD solder connection (figure 2; column 3, lines 45 - 50). Pennisi further teaches that the adhesive resin is an epoxy-based flux encapsulant (column 3, lines 5 - 15)."

The Examiner goes on to assert that, "it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the structure of

Cobbley, such that the underfill resin is formed from an epoxy-based flux encapsulant that completely fills the space between the SMD and substrate, forming fillets around the solder connections, as suggested by Pennisi. The rationale is as follows: A person having ordinary skill in the art would have been motivated to form the resin of Cobbley such that it completely fills the space between the SMD and substrate, forming fillets around the solder connections, because Cobbley notes that the resin is used as a flip chip adhesive underfill (Cobbley, column 8, lines 55 - 58), and Pennisi shows that a flip chip underfill needs to completely fill the space between the chip and substrate in order to provide maximum environmental protection for the device (Pennisi, column 2, lines 30 - 50). Furthermore, Pennisi shows that providing an excess of underfill, such that fillets are formed leads to the formation of a continuous seal around the periphery of the device to fully protect and encapsulate the device (Pennisi, column 3, lines 45 - 50; line 65 - column 4, line 5). A person skilled in the art would further use an epoxy flux encapsulant material as the underfill, because Pennisi shows that such an underfill material provides fluxing action for the solder interconnection, while protecting the device from contamination or the need for extra cleaning steps (see Pennisi, column 3, lines 5 - 15; 40 - 67; column 2, lines 1 - 30). Since Pennisi further suggests that any surface mount component using solder connections may be used as the chip component of Pennisi (see Pennisi, column 3, lines 50 - 56), it is apparent that the underfill structure of Pennisi could be applied to the surface mount capacitor of Cobbley".

Applicants do not agree with the Examiner's position that a person of "ordinary skill in the art would have been motivated to form the resin of Cobbley such that it completely fills the space between the SMD and substrate, forming fillets around the

solder connections, because Cobbley notes that the resin is used as a flip chip adhesive underfill".

Cobbley, et al. is directed to a method of applying a dispersion of particles of a thermoplastic polymer in a liquid medium onto semiconductor wafers, dies, lead frames and PCB, for example, to form bonding layers, pads and bumps, etc. As stated in Col. 8, line 43 et seq., the method of the invention "produces structures on semiconductor components such as protective coatings, bonding layers, pads, bumps, and ball grid arrays for semiconductor fabrication, particularly semiconductor packaging applications (emphasis added). Cobley, et al. go on to state "these structures may be conductive or nonconductive, depending upon the desired application".

In regard to Figure 1 of Cobbley, et al., Cobbley, et al. state that "nonconductive thermoplastic bonding layer 15 holds device 10 in place for processing". Thus, the nonconductive thermoplastic may be used to hold device 10 in place for further processing. Alternatively, Cobbley, et al. state in Col. 8, lines 53 et seq. the "method is useful in lead-on-chip (LOC) applications (e.g. bonding of leads to chips and lead frames), chip on board (COB) applications (e.g., die attach adhesives, wire bonding, tape automated bonding (TAB), and for use in making flip chip conductive bumps, flip chip underfill, bump dam material, and ball grid array bumps" (emphasis added).

Accordingly, it is clear that the dispersion of Cobbley, et al. can be conductive or nonconductive and can be used in a whole variety of ways, such as, making bump dams, balls for BGAs, line patterns, adhesives for holding components in place for processing and protective coatings. Given the scope of these applications and the nature of the dispersion composition and process for hardening, Applicants are at a loss to see how one

skilled in the art would be motivated to use the adhesive material with fluxing agent of Pennisi, et al. in Cobbley, et al. Applicants contend that the adhesive material of Pennisi, et al. would not do all of what Cobbley, et al. wants their material to do. More particularly, it would appear that using the Pennisi, et al. adhesive material in Cobbley, et al. would render Cobbley, et al. inoperative for its intended purposes.

To form a structure in Cobbley, et al. in an effort to meet Applicants' claimed structure, the Examiner suggests that it would have been obvious to one of ordinary skill in the art to modify the structure of Cobbley, et al., such that the underfill resin is formed from an epoxy-based flux encapsulant that completely fills the space between the SMD and substrate, forming fillets around the solder connections. However, neither Pennisi, et al. nor Cobbley, et al. teach Applicants' claimed structure. Moreover, neither Pennisi, et al. nor Cobbley, et al. teach how such claimed structure could be formed, even if envisioned. Applicants' specification sets forth a particular process for forming fillets. Neither Pennisi, et al. or Cobbley, et al. teach anything that would enable one skilled in the art to form the encapsulation and fillets that Applicants obtain. It is difficult to understand how one skilled in the art would be motivated to combine Pennisi, et al. with Cobbley, et al. given their disparate teachings. It is even more difficult to understand how, even if combined, the combination would yield a structure that neither reference teaches nor suggests, and even if the structure be suggested, how such structure would be formed, i.e. enabled.

In regard to the latter, Applicants note that their specification on pages 6, 7 and 8 particularly points out the conditions needed to form the fillets and the effects of having too little or too much encapsulant. Neither Pennisi, et al. or Cobbley, et al. teach anything

akin to Applicants' teachings and to suggest, as the Examiner has done, that combining Pennisi, et al. with Cobbley, et al. will lead to a structure neither reference teaches, by a process neither reference teaches takes more than skill in the art - it takes, at the least, Applicants' teachings.

It is noted that the Examiner states that Pennisi, et al. "shows that providing an excess underfill, such fillets are formed leads to the formation of a continuous seal around periphery of the device". However, the continuous seal around the periphery of the Pennisi, et al. device acts to seal solder balls on the active surface of the Pennisi, et al. chip device. It does not form a seal or fillet on solder on both a lower electrical contact surface and an upper electrical contact surface, as claimed by Applicants. The fillets formed on Applicants' SMD solder connection are a result of having sufficient excess resin and sufficient viscosity "so that the excess encapsulant spills out and flows around the reflowed solder" (page 8, lines 21 et seq.) (emphasis added). Applicants show how this is achieved in Figures 1a - 1d. Pennisi, et al. cannot achieve this without using Applicants' teachings of the process employed and structure thereby obtained.

In regard to Applicants' claimed structure, Applicants would like to point out that in the Examiner's final rejection of Claim 21, certain structural limitations were overlooked by the Examiner. For example, Claim 21 recites "a passive SMD having at least two electrical contacts each having a lower electrical contact surface and an upper electrical contact surface" (emphasis added). Although Cobbley, et al. show this, Pennisi, et al. do not. Pennisi, et al. apparently have a single contact surface beneath solder bump 140.

Claim 21 further recites "said at least said lower electrical contact surface and said upper electrical contact surface at the terminus thereof of said at least two electrical contacts each respectively bonded by a solder connection to said at least two electrical contacts on said substrate such <u>said upper contact surface is covered by said solder connection</u>" (emphasis added). Neither Pennisi, et al. or Cobbley, et al. teach such structure, i.e. an upper contact surface <u>covered</u> by solder.

Finally, Claim 21 recites "said passive SMD encapsulated by a resin such that ... said resin further forming <u>fillets around each said passive SMD solder connection including forming fillets covering said solder connection covering said upper contact surface</u>" (emphasis added). Neither Cobbley, et al. or Pennisi, et al., either alone or in combination, teach such structure, i.e., <u>fillets covering solder covering an upper contact surface</u>. Moreover, neither Cobbley, et al. or Pennisi, et al. either alone or in combination, <u>teach or suggest a process that will yield such structure</u>.

Claim 22 likewise claims the structure of Claim 21. In addition, Claim 22 recites that the resin of Claim 21 is formed from an epoxy-based flux encapsulant with flux combined into a one part epoxy system. Cobbley, et al. fail to teach such encapsulant structure on an SMD and Pennisi, et al. fail to teach such encapsulant structure on an SMD having both a lower electrical contact surface and an upper electrical contact surface at the terminus thereof.

Summary

Applicants believe that, given the differences in teachings between Cobbley, et al. and Pennisi, et al., one skilled in the art would clearly not be motivated to combine these references. However, given their differences in teachings, even if combined, there would be no reasonable expectation of success without, at the least, Applicants' teachings. Finally, even if combined, the combination fails to teach all of the structural claim limitations.

Conclusion

In view of Applicants' amendment and remarks, Applicants firmly believe that the application is now in condition for allowance. Accordingly, Applicants respectfully request the Examiner to reconsider and withdraw the outstanding rejection, allow the claims as now presented, and pass the case to issue.

Respectfully submitted,

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